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scientists, engineers, and technicians in trade and regulated industries: 1988

surveys of science resources series
national science foundation

detailed statistical tables

NSF 90-317

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principal author: joseph p. gannon

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Contributors

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SURVEYS OF SCIENTISTS AND ENGINEERS IN INDUSTRY

The National Science Foundation (NSF) supports three survey efforts covering scientists and engineers in industry: The Occupational Employment Statistics (OES) survey, the survey of Research and Development in Industry (RDI), and The Scientific and Technical Personnel Data System (STPDS). These surveys cover different aspects of science and engineering (S/E) employment or characteristics. Because their survey definitions, concepts, coverage, and methods of collection vary widely, the resulting estimates differ. Two of the survey questionnaires are company-based, i.e., are completed by employers: the OES survey occurs at the establishment (workplace) level, and the RDI survey occurs at the company headquarters level. The STPDS questionnaires are completed by the scientists and engineers themselves, and thus are population-based.

The OES survey, conducted by the Bureau of Labor Statistics (BLS), is an establishment-based survey of nonfarm employers who report the employment of their wage and salary workers by job type. NSF supports this survey to obtain estimates of the numbers in scientific, engineering, and technician (SET) jobs. Published data provide job and industry detail. The RDI is a company-based survey of R&D-performing firms conducted by the Census Bureau. Its primary objective is to provide statistics on R&D expenditures in U.S. industry. It also collects data on the full-time-equivalent (FTE) number of total scientists and engineers who perform R&D in these firms. Unlike the other two surveys, this survey excludes social scientists. The data provided cover only total numbers of R&D personnel. Further details are in the report titled Research and Development in Industry: 1988 (NSF 90-319).

The STPDS is a series of surveys that provides employment and other characteristics of personnel who self-classify as scientists (including social and behavioral scientists) and engineers. The resulting S/E estimates include some employed in non-S&E jobs, and are published by work and degree field, S/E field, sector of employment (business, government, academia, etc.), and primary work activity (R&D, teaching, etc). The published information does not provide industry detail. For further details see the report, U.S. Scientists and Engineers: 1988 (NSF 90-314).

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GENERAL NOTES

This report presents national estimates of employment of scientists, engineers, and technicians (SET) in jobs in trade and regulated industries in 1988. The data were developed from the OES Survey, which is a Federal/State program that produces national and State estimates of employment by industry for nonfarm wage and salary workers. BLS has the primary responsibility for developing survey procedures and providing technical guidance and assistance with problems. State Employment Security Agencies implement the survey at State levels and prepare current and projected employment statistics for these labor markets. Some States also prepare sub-State estimates.

NSF has enhanced the BLS effort since 1977 by financing the collection of full details on the types of scientific and technical jobs filled by industry. Analysis of this information provides insight into the dynamics of the labor market as demand for scientists, engineers, and technicians responds to variations in growth among industries, and into the impact of technology and other factors upon industry. Requests for previously published data and additional information should be addressed as follows:

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SECTION A. TECHNICAL NOTES

Scope of the Survey

The Occupational Employment Statistics (OES) Survey[1] provides extensive detail on employed scientists, engineers, and technicians in U. S. industry. It is conducted in 3-year cycles: Manufacturing industries are surveyed in the first year; mining, construction, and financial and other service industries in the nonmanufacturing sector are surveyed in the second; and trade, communications, transportation, and public utilities are surveyed in the third year. Data in this report are from the 1988 Trade and Regulated Industries Survey, covering Standard Industrial Classification (SIC) codes 40-42 and 43-59. The reference dates of the survey were the weeks that included April 12, May 12, or June 12, depending on the SIC of the sampled unit. The survey covered all 50 States and the District of Columbia.

Method of Collection

Survey forms for the OES Survey are mailed to personnel offices of most sample establishments. In a few cases forms are mailed to the company headquarters. (The responses supplied by the companies are then broken down by establishment and forwarded to the State Employment office in which the establishments are located.) Nonrespondents receive two additional mailings at 6-week intervals with telephone followups. In some cases, field personnel visit those nonrespondent companies deemed critical to the survey because of their size.

Survey questionnaires are tailored for specific industries at the 2-digit SIC level so that data can be aggregated at that level. The survey is conducted at the 3-digit SIC level. Each industry surveyed receives a separate questionnaire in which job details are based on the jobs of all or almost all employees in the industry. On the questionnaires, the specific jobs are grouped under broad headings, each with a residual category for jobs not explicitly listed on the survey form. Abbreviated survey forms that combine kindred jobs are sent to small establishments to diminish the reporting burden and to encourage participation.

Limitations on Analysis

Data collection methodology in the OES Survey introduces several problems to take into account when using these data. First, the OES survey tends to understate employment in specific fields. A job title is listed explicitly on an industry's questionnaire only if BLS judges it to be for a major job class in that industry. For example, biologists are not a major job class for the Communications industry, and thus are not separately identified on the survey form; rather, they are part of the life scientists class, which is separately identified. Second, this same Survey characteristic can be expected to overstate cross-industry differences in staffing patterns; the finer the level of job detail, the more serious the problem. Finally, BLS in 1988 increased the number of industries in which S/E managers were separately identified.

Job and Industry Classification

The OES Survey collects data for approximately 60 SET jobs, and uses two classification systems--the Dictionary of Occupational Titles (DOT) and the Standard Occupational Classification System (SOC). The DOT system is used to develop job categories and definitions because its classification scheme is very detailed; the broad job categories used in this report are SOC categories. These two classification systems are then combined to form the OES classification system used to report the jobs data.

Surveyed industries are classified according to the SIC System, revised in 1987. Reporting establishments are categorized on the basis of their major product or activity the previous calendar year.

Reconciliation with 1985 OES Data

The 1987 revisions to the SIC coding system were used in the 1988 OES survey, so that only overall SET estimates in this report fully compare with those of the 1985 report. Even so, the numbers of SET personnel in most 2-digit level industries compare for 1988 and 1985. At the 3-digit SIC level, relatively fewer industries have comparable data for 1988 and 1985. Industry title changes also occurred at the 2- and 3- digit levels, but did not affect the numbers of scientists, engineers, and technicians.

Table B-1 covers personnel by 2- and 3-digit levels of industry, table B-2 by 2-digit level of industry, and table B-3 by 3-digit level of industry.

The numbers of scientific and technical managers given in this report should not be compared to those published in Scientists, Engineers, and Technicians in Trade and Regulated Industries: 1985 (NSF 88-313). The 1988 survey found 25,500 scientific and technical managers, double the number in 1985. This increase largely reflected a change in survey procedures by which reporting of scientific and technical managers was enhanced in 1988.

Concepts

An establishment, such as a factory, is the primary sampling unit in the survey. In general, it represents a single physical location and engages in one type of economic activity.

This report covers several types of personnel: Full-time and part-time workers; workers on paid vacation or on other types of leave; workers on unpaid short-term absence; salaried officers, executives, and staff of firms; employees temporarily assigned to other units; and employees for whom the unit is a permanent duty station. Excluded from coverage are proprietors (owners and partners of unincorporated firms), unpaid family workers, and workers on extended leave.

The data on scientists and engineers in this report reflect the numbers in scientific and engineering jobs, not in fields of study. Employees are categorized as scientists or engineers if they work at a level of knowledge equivalent to that acquired by completion of a 4-year college course with an S/E major, even if a college degree was not obtained. Employees who perform multiple functions are reported in the job requiring the highest level of such knowledge. Supervisors who spend at least 20 percent of their time doing work similar to that of individuals under their supervision are classified in the job category most closely related to their work duties.

Sampling Procedures

The OES Survey is a probability sample with a sampling frame based on lists of establishments covered by State Unemployment Insurance (U.I.) systems. Because each cooperating State selects its own sample, the reference date of the sampling frame varies by date when the last sample frame was updated and the survey was conducted. The reference date for sampling in the States BLS surveyed was the second quarter of 1988.

The survey universe is stratified by industry and size of establishment unit because these characteristics are believed to be primary determinants of job staffing patterns. Nine size-classes are represented, based on numbers of people employed: 1 to 3, 4 to 9, 10 to 19, 20 to 49, 50 to 99, 100 to 249, 250 to 499, 500 to 999, and 1,000 and over. Because U.I. reporting units with 1 to 3 employees are not sampled in every State, units with 4 to 9 employees receive larger weights to represent employment in the smaller size-classes. Reporting units with 250 or more employees are included in the sample with certainty. Samples for noncertainty size-classes are developed to produce State estimates with target relative errors of 10 percent, 15 percent, or 20 percent at one standard deviation. This is done for SIC groups based on averages of occupational rates and coefficients of variation (CV's) from the previous survey of those groups for a set of typical occupations. This SIC sample size is allocated to the classes in proportion to their employment. The sample is selected systematically with equal probability within each State/SIC/area/-size-class cell. States have the option of targeting relative errors of 10 percent, 15 percent, and 20 percent for noncertainty size-classes. Some States vary the target relative error by SIC to decrease the cost by reducing the sample size.

Response

Of the reporting units selected, 257,324 were eligible, i.e., those out of business and out of scope were excluded. Usable responses were obtained from 202,717 units. The response rates were 78.8 percent based on units and 78.5 percent based on weighted employment.

Estimation

Weights are determined for the sample units for which usable responses are received. Each weight is composed of two factors: The first is the inverse of the probability of selection; the second is the nonresponse adjustment factor. For each of the 3-digit SIC/State/size-class sampling cells, the nonresponse factor is calculated as:

$$\frac{\text{Weighted employment of all eligible units in sample}}{\text{Weighted employment of all responding eligible units}}$$

Sample employment is taken from the sampling frame. If the nonresponse factor in a cell exceeds a predetermined maximum factor, which increases with the number of respondents in the cell, the cell is collapsed with other homogeneous cells within an SIC until the factor for the combined cell is not greater than the appropriate maximum factor. If the collapsing procedure terminates (i.e., no more cells are available for collapse) before satisfying the constraint, then the appropriate maximum factor is used. For size-classes 1 through 6, homogeneous cells are determined to be other size cells within the SIC and State. For size-classes 7 through 9, homogeneous cells are determined to be other State cells within the SIC and size-class. The weight for each unit is the product of the nonresponse adjustment factor and the probability of selection.

A combined ratio estimate of occupational employment is used to develop national estimates. The auxiliary variable used is total employment. The estimating formula is:

$$\hat{P} = \sum_{i} \left\{ \frac{\sum_{j} \sum_{k} w_{ijk} \, p_{ijk}}{\sum_{j} \sum_{k} w_{ijk} \, e_{ijk}} \right\} M_i$$

where $\hat{P}$ = 2-digit industry occupational employment estimate,
i = 3-digit industry within a 2-digit industry,
j = size class,
k = establishment,
w_{ijk} = weight after nonresponse adjustment in ith industry, jth size class and kth establishment,
p_{ijk} = occupational employment in ith industry, jth size class and kth establishment,
e_{ijk} = total employment in ith industry, jth size class and kth establishment, and
M_i = population total employment in ith industry.

The population value of total employment (M_1) is obtained from the BLS Survey of Employment, Hours, and Earnings.

The following is the standard formula for the sampling variance for a combined ratio estimate:[2]

$$\begin{aligned} \mathrm{Var}(\hat{P}) = \sum_{i} \sum_{j} & \left\{ \frac{N_{ij}^{2} \, (1 - f_{ij})}{n_{ij}} \right\} \\ & \times [S_{pij}^{2} + (R_i^{2})(S_{eij}^{2}) \\ & - 2R_i(K_{ij})(S_{pij})(S_{eij})] \end{aligned}$$

where $\mathrm{Var}(\hat{P})$ = variance of $\hat{P}$
i = 3-digit industry within 2-digit industry,
j = size class,
N_{ij} = total number of units in the ith industry and jth size class,
f_{ij} = sampling fraction in the ith industry and jth size class,
n_{ij} = number of sample units in the ith industry and jth size class,
S_{pij} = standard deviation of p within ith industry and jth size class,
S_{eij} = standard deviation of e within ith industry and jth size class,
K_{ij} = correlation coefficient between p and e within ith industry and jth size class, and
R_i = the ratio of total p to total e in the ith industry.

The variance for each occupational estimate is estimated using the following formula:

$$\mathrm{Var}(\hat{P}) = \sum_i \sum_j (T_{ij}) \cdot (V_{ij}^2)$$

where M_i = benchmark total employment in the ith industry,

where,

$$T_{ij} = \frac{M_{ij} - e_{ij}}{M_{ij}}$$

$$\times \frac{\left(\sum_k w_{ijk}^2\right) \cdot \left(\sum_k w_{ijk}\right)}{\left(\sum_k w_{ijk}\right)^2 - \left(\sum_k w_{ijk}^2\right)}$$

$$\times \left\{\frac{M_{ij}}{\sum_k w_{ijk}\, e_{ijk}}\right\}^2$$

$$V_{ij}^2 = \sum_k (w_{ijk}\, p_{ijk}^2)$$

$$+ R_{ij}^2 \sum_k (w_{ijk}\, e_{ijk}^2)$$

$$- 2R_{ij} \sum_k (w_{ijk}\, p_{ijk}\, e_{ijk})$$

$$M_{ij} = \frac{\sum_k w_{ijk}\, e_{ijk}}{\sum_j \sum_k w_{ijk}\, e_{ijk}} M_i,$$

$R_i = (\Sigma_j \Sigma_k w_{ijk}\, p_{ijk}) / (\Sigma_j \Sigma_k w_{ijk}\, e_{ijk})$, and

$e_{ij} = \Sigma_k e_{ijk}$.

and all other terms are as defined previously. This formula is almost a computational form of the standard formula, V(P), already given. One simplifying assumption is made:

$$W_{ijk} = C_{ij} \text{ for all } k \text{ in a given } ij \text{ cell}$$

That is, the weights are equal to a constant C within a given 3-digit industry/size-class cell. The total effect of this assumption on the variance estimate is not measured.

Reliability of Estimates

The estimates developed from the sample may differ from the results of a census of all establishments in the same sample frame. Two types of errors are possible in an estimate based on sample data: sampling and nonsampling. Sampling error occurs because observations are made only on a sample, not on the entire population. Nonsampling error can be attributed to many sources: inability to obtain information about all cases in a sample; differences in respondents' interpretations of questions; inability of respondents to provide correct information; errors made in recording, coding, or processing the data; errors made in estimating values for missing data; and failure to represent all units in the population.

The particular sample used in this survey is one of a large number of possible samples of the same size that could have been selected using the same sample design. Estimates derived from the different samples would differ from each other. The deviation of a sample estimate from the average of all possible samples is called the sample error. The standard error of a survey estimate is a measure of the variation among the estimates from all possible samples. Thus, it is a measure of the precision with which an estimate from a particular sample approximates the average results of all possible samples. The relative standard error is defined as the standard error of the estimate divided by the value being estimated. The variance is the standard error squared. In this report, the term "relative error" is synonymous with the term "relative standard error."

The sample estimate and an estimate of its standard error allow construction of interval estimates with prescribed confidence that the interval includes the average result of all possible samples obtainable from the sample design for this survey.

To illustrate, if all possible samples were selected, and each of these were surveyed under essentially the same conditions, and an estimate and its estimated standard error were calculated for each sample, then

(1) Approximately 68 percent of the intervals from one standard error below to one standard error above the derived estimate would include the average value of all possible samples.
(2) Approximately 90 percent of the intervals from 1.6 standard errors below to 1.6 standard errors above the derived estimate would include the average of all possible samples.
(3) Approximately 95 percent of the intervals from two standard errors below to two standard errors above the derived estimate would include the average of all possible samples.
(4) Almost all intervals from three standard errors below to three standard errors above the derived estimate would include the average of all possible samples.

An inference that the complete coverage value would be within the indicated ranges would be correct in approximately the frequencies shown above.

For example, suppose an estimated employment total is 5,000 with an associated relative error (relative standard error) of 2 percent. Based on these data, the standard error is 100 (= 5,000 X 0.02) and the 68 percent confidence interval is from 4,900 to

5,100 (5,000 + or - 100). A conclusion that the average estimate of total employment lies within a range computed in this manner would be correct for roughly 68 percent of all possible samples.

The relative errors primarily indicate the magnitude of the sampling error but do not measure biases in the data resulting from nonsampling error. Many edit and quality control procedures are used to reduce the biases arising from errors in recording, coding, and processing the data. The adjustments made for nonrespondents assume that their characteristics are the same as those of the respondents in a given 3-digit SIC/State/size-class sampling cell. To the extent that this is not true, bias is introduced into the data. The magnitude of these biases is unknown.

Particular care should be exercised in the interpretation of estimates based on a small number of cases, or on small differences between estimates, because of relatively large sampling errors and the unknown magnitude of the biases.

FOOTNOTES

1/ A description of the OES Survey can be found in the Department of Commerce "The National OES-Based Industry-Occupational Matrix, 1982 and 1995" (Springfield, Va.: National Technical Information Service).

2/ This formula is derived from the equation for computing the variance of a ratio estimate given by William Cochran in Sampling Techniques (New York, N.Y.: John Wiley and Sons, 1977), p. 166.

SECTION B. DETAILED STATISTICAL TABLES

NOTE

Industries identified in the tables of this report are verbatim from the Numerical List of Short Titles of the Standard Industrial Classification (SIC) system, revised 1987 edition. SET numbers for a few industries at the 2-digit SIC level in 1988 (table 2) differ from those in the prior report on trade and regulated industries for 1985 because the industries were recoded. Greater noncomparability occurred at the 3-digit level of detail (tables 1 and 3) because of more extensive recoding. The numerous industry title changes did not affect the comparability of the 1988 and 1985 data.

Estimates on the tables in this report may be compared with those for 1985, only after consulting the 1987 SIC revisions to determine industry comparability.

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B-1. Scientists, engineers, and technicians in trade and regulated industries, by major occupational group and detailed industry of employment: 1988. 13

B-2. Scientists, engineers, and technicians in trade and regulated industries, by detailed occupation and broad industry group of employment: 1988 15

B-3. Scientists, engineers, and technicians in each trade and regulated industry as a percent of total employment in the industry and the relative error: 1988. 18

TABLE B-1. Scientists, engineers, and technicians in trade and regulated industries, by major occupational group and detailed industry of employment: 1988

(numbers of filled jobs in thousands)

Industry	Scientific and technical personnel (1)		S/E (2) managers		Scientists		Engineers		Technicians	
	Total	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total trade and regulated industries.....	498.1	100.0	25.5	100.0	55.5	100.0	146.5	100.0	270.6	100.0
Transportation, communications, and utilities..............................	252.5	50.7	15.2	59.7	31.3	56.4	81.5	55.6	124.5	46.0
Transportation..............................	23.4	4.7	1.6	6.4	6.3	11.3	6.1	4.1	9.4	3.5
Railroad transportation.................	4.5	.9	.5	1.9	.9	1.6	1.7	1.2	1.4	.5
Local and interurban transit...........	.2	(3)	-	-	.1	.1	.1	(3)	.1	(3)
Local and suburban transportation.....	.2	(3)	-	-	(3)	.1	.1	(3)	(3)	(3)
School buses............................	(3)	(3)	-	-	(3)	(3)	-	-	(3)	(3)
Trucking and warehousing................	4.1	.8	.5	2.0	1.1	2.1	-	-	2.4	.9
Trucking and courier services, ex. air	3.7	.7	.4	1.8	1.0	1.8	-	-	2.2	.8
Public warehousing and storage........	.4	.1	.1	.2	.1	.3	-	-	.2	.1
Water transportation....................	1.5	.3	.1	.3	.2	.3	1.0	.7	.1	.1
Deep sea foreign trans. of freight....	.3	.1	-	-	.1	.2	.2	.2	-	-
Deep sea domestic trans. of freight...	.2	(3)	-	-	-	-	.2	.1	-	-
Water transportation of freight, nec..	.1	(3)	(3)	(3)	(3)	(3)	.1	.1	(3)	(3)
Water transportation of passengers....	.1	(3)	(3)	.1	-	-	(3)	(3)	(3)	(3)
Water transportation services.........	.7	.2	(3)	.2	.1	.1	.5	.4	.1	(3)
Air transportation......................	10.2	2.0	.4	1.6	3.6	6.4	2.5	1.7	3.6	1.3
Air transportation, scheduled.........	8.6	1.7	.3	1.1	3.5	6.3	1.9	1.3	3.0	1.1
Air transportation, nonscheduled......	.1	(3)	(3)	.2	(3)	(3)	(3)	(3)	.1	(3)
Airports, flying fields, and services.	1.4	.3	.1	.3	.1	.1	.7	.5	.6	.2
Pipelines, except natural gas..........	2.0	.4	.1	.4	.1	.2	.7	.5	1.1	.4
Transportation services.................	.9	.2	(3)	.2	.3	.5	-	-	.6	.2
Freight transportation arrangement....	.8	.2	(3)	.2	.3	.5	-	-	.4	.2
Rental of railroad cars................	(3)	(3)	-	-	-	-	-	-	(3)	(3)
Miscellaneous transportation services.	.1	(3)	-	-	(3)	(3)	-	-	.1	(3)
Communications..............................	118.0	23.7	6.1	23.8	12.3	22.3	33.1	22.6	66.5	24.6
Telephone communication................	71.0	14.3	3.6	14.2	11.4	20.6	27.0	18.4	29.0	10.7
Telegraph & other communications......	1.5	.3	.2	.9	.1	.2	.5	.4	.7	.3
Radio and television broadcasting.....	32.8	6.6	1.4	5.6	.3	.5	2.8	1.9	28.2	10.4
Cable and other pay TV services.......	6.7	1.3	.6	2.3	.3	.5	.9	.6	4.9	1.8
Communication services, n.e.c.........	5.9	1.2	.2	.8	.3	.6	1.7	1.2	3.7	1.4
Utilities and sanitary services..........	111.1	22.3	7.5	29.4	12.7	22.8	42.3	28.9	48.6	18.0
Electric services.......................	67.4	13.5	4.4	17.2	7.4	13.4	27.1	18.5	28.5	10.5
Gas production and distribution.......	11.6	2.3	1.1	4.4	1.8	3.2	2.8	1.9	5.8	2.2
Combination utility services..........	28.3	5.7	1.2	4.8	2.7	5.0	11.5	7.8	12.8	4.7
Water supply............................	1.0	.2	.1	.5	.2	.3	.2	.2	.4	.2
Sanitary services.......................	2.7	.5	.6	2.2	.5	1.0	.6	.4	1.0	.4
Steam and air-conditioning services...	.1	(3)	(3)	.2	-	-	-	-	(3)	(3)
Irrigation systems......................	(3)	(3)	(3)	(3)	-	-	-	-	(3)	(3)
Wholesale and retail trade................	245.7	49.3	10.3	40.3	24.2	43.6	65.0	44.4	146.1	54.0
Wholesale trade............................	219.6	44.1	7.8	30.7	18.2	32.9	61.2	41.7	132.4	48.9
Wholesale trade, durable goods..........	193.6	38.9	5.9	23.1	14.0	25.2	57.3	39.1	116.5	43.1
Motor vehicles, parts, and supplies...	6.3	1.3	.3	1.0	.4	.7	2.6	1.8	3.0	1.1
Furniture and homefurnishings..........	.9	.2	(3)	.1	.1	.2	.1	(3)	.7	.3
Lumber and construction materials.....	1.5	.3	.1	.2	.1	.2	.2	.2	1.2	.4
Professional & commercial equipment...	101.1	20.3	2.4	9.5	8.1	14.6	31.9	21.8	58.7	21.7
Metals and minerals, except petroleum.	1.7	.3	.1	.5	.1	.3	.4	.3	1.0	.4
Electrical goods........................	45.4	9.1	1.8	7.1	3.5	6.3	11.0	7.5	29.1	10.8
Hardware, plumbing & heating equipment	5.7	1.2	.2	.8	.2	.3	1.9	1.3	3.4	1.3
Machinery, equipment, and supplies....	28.5	5.7	.8	3.3	1.3	2.4	8.8	6.0	17.5	6.5
Miscellaneous durable goods............	2.4	.5	.2	.6	.2	.3	.3	.2	1.8	.7
Wholesale trade, nondurable goods.......	26.0	5.2	1.9	7.5	4.3	7.7	3.9	2.7	15.9	5.9
Paper and paper products...............	1.5	.3	.1	.2	.1	.3	.2	.1	1.1	.4
Drugs, proprietaries, and sundries....	3.7	.8	.3	1.3	1.1	1.9	.2	.2	2.1	.8
Apparel, piece goods, and notions.....	1.6	.3	.1	.4	.3	.5	.1	.1	1.2	.4
Groceries and related products........	5.7	1.2	.4	1.7	1.0	1.7	.5	.4	3.8	1.4
Farm-product raw materials.............	.9	.2	.1	.2	.1	.3	(3)	(3)	.6	.2
Chemicals and allied products.........	3.9	.8	.4	1.6	.4	.8	1.3	.9	1.8	.7
Petroleum and petroleum products......	3.5	.7	.3	1.1	.3	.5	1.4	.9	1.6	.6
Beer, wine, and distilled beverages...	.6	.1	(3)	(3)	.1	.1	-	-	.5	.2
Misc. nondurable goods..................	4.6	0.9	0.2	0.9	0.9	1.6	0.2	0.1	3.2	1.2

See footnotes at end of table.

TABLE B-1. Scientists, engineers, and technicians in trade and regulated industries, by major occupational group and detailed industry of employment: 1988--Continued

(numbers of filled jobs in thousands)

Industry	Scientific and technical personnel (1)		S/E (2) managers		Scientists		Engineers		Technicians	
	Total	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Retail trade	26.0	5.2	2.5	9.7	5.9	10.7	3.9	2.6	13.7	5.1
Building materials & garden supplies	2.2	.4	(3)	(3)	.2	.4	.1	.1	1.8	.7
Lumber and other building materials	1.7	.3	-	-	.1	.3	.1	.1	1.4	.5
Paint, glass, and wallpaper stores	.1	(3)	-	-	-	-	-	-	.1	(3)
Hardware stores	.1	(3)	-	-	-	-	-	-	.1	(3)
Retail nurseries and garden stores	.2	(3)	(3)	(3)	.1	.1	(3)	(3)	.1	.1
Mobile home dealers	(3)	(3)	-	-	-	-	-	-	(3)	(3)
General merchandise stores	7.1	1.4	1.0	3.8	1.8	3.2	1.4	1.0	2.9	1.1
Department stores	6.5	1.3	.9	3.6	1.8	3.2	1.3	.9	2.5	.9
Variety stores	.1	(3)	(3)	.2	-	-	(3)	(3)	.1	(3)
Misc. general merchandise stores	.4	.1	(3)	(3)	-	-	.1	(3)	.3	.1
Food stores	1.6	.3	.2	.7	.5	.8	.1	.1	.8	.3
Grocery stores	1.6	.3	.2	.7	.5	.8	.1	.1	.8	.3
Candy, nut, and confectionery stores	(3)	(3)	-	-	-	-	-	-	(3)	(3)
Miscellaneous food stores	(3)	(3)	-	-	(3)	(3)	-	-	-	-
Automotive dealers & service stations	.5	.1	(3)	(3)	(3)	(3)	.2	.1	.3	.1
Auto and home supply stores	.2	(3)	(3)	(3)	(3)	(3)	-	-	.2	.1
Gasoline service stations	.2	(3)	-	-	-	-	.2	.1	(3)	(3)
Boat dealers	(3)	(3)	-	-	-	-	-	-	(3)	(3)
Automotive dealers, n.e.c	(3)	(3)	-	-	-	-	-	-	(3)	(3)
Apparel and accessory stores	1.8	.4	(3)	.2	.5	.9	.1	(3)	1.1	.4
Men's and boys' clothing stores	.1	(3)	(3)	(3)	(3)	(3)	-	-	.1	(3)
Women's clothing stores	.6	.1	-	-	.2	.3	-	-	.4	.2
Women's accessory and specialty stores	(3)	(3)	-	-	-	-	-	-	(3)	(3)
Children's and infants' wear stores	(3)	(3)	-	-	-	-	(3)	(3)	(3)	(3)
Family clothing stores	.6	.1	(3)	.2	.2	.3	(3)	(3)	.3	.1
Shoe stores	.4	.1	-	-	.1	.2	(3)	(3)	.3	.1
Misc. apparel and accessories stores	(3)	(3)	-	-	-	-	(3)	(3)	(3)	(3)
Furniture and homefurnishings stores	6.4	1.3	.4	1.5	1.1	2.0	1.0	.7	3.9	1.4
Furniture and homefurnishings stores	.5	.1	(3)	.1	.1	.2	(3)	(3)	.4	.2
Household appliance stores	.4	.1	(3)	(3)	.1	.1	.1	(3)	.2	.1
Radio, television, & computer stores	5.5	1.1	.4	1.4	1.0	1.7	.9	.6	3.2	1.2
Eating and drinking places	.6	.1	(3)	.2	.1	.2	.1	(3)	.4	.1
Eating and drinking places	.6	.1	(3)	.2	.1	.2	.1	(3)	.4	.1
Miscellaneous retail stores	5.9	1.2	.8	3.1	1.7	3.1	.9	.6	2.5	.9
Drug stores and proprietary stores	1.1	.2	.4	1.4	.2	.4	.1	.1	.4	.1
Liquor stores	(3)	(3)	-	-	-	-	-	-	(3)	(3)
Used merchandise stores	(3)	(3)	-	-	-	-	-	-	(3)	(3)
Miscellaneous shopping goods stores	1.5	.3	.1	.6	.4	.7	.3	.2	.6	.2
Nonstore retailers	2.7	.5	.3	1.0	1.1	1.9	.3	.2	1.1	.4
Fuel and ice dealers	.1	(3)	-	-	(3)	.1	(3)	(3)	.1	(3)
Retail stores, n.e.c	.5	.1	(3)	.1	-	-	.1	.1	.4	.1

(1) Scientific, engineering, and technical personnel
(2) Scientific and engineering
(3) No amount available or value less than .05 for levels and less than .005 for percents
NOTES: Because of rounding, components may not add to totals.
"-" = No amount available.
n.e.c. = Not elsewhere classified.
SOURCES: Bureau of Labor Statistics and National Science Foundation, SRS

TABLE B-2. Scientists, engineers, and technicians in trade and regulated industries, by detailed occupation and broad industry group of employment: 1988

(numbers of filled jobs in thousands)

Industry	Scientific and technical personnel (1)	Managers (2)	Scientists				
			Total	Physical	Mathematical	Life	Computer analysts
Total trade and regulated industries.....	498.1	25.5	55.5	2.1	3.5	2.5	47.3
Transportation and public utilities......	252.5	15.2	31.3	2.1	3.5	.9	24.7
Transportation...........................	23.4	1.6	6.3	-	1.9	(3)	4.3
Railroad transportation..................	4.5	.5	.9	-	.3	(3)	.6
Local and interurban passenger transit.	.2	-	.1	-	-	-	.1
Trucking and warehousing.................	4.1	.5	1.1	-	-	-	1.1
Water transportation.....................	1.5	.1	.2	-	-	(3)	.2
Transportation by air....................	10.2	.4	3.6	-	1.6	(3)	1.9
Pipelines, except natural gas............	2.0	.1	.1	-	-	(3)	.1
Transportation services..................	.9	(3)	.3	-	-	-	.3
Communications...........................	110.0	6.1	12.3	-	-	-	12.3
Electric, gas, and sanitary services.....	111.1	7.5	12.7	2.1	1.6	.9	8.0
Wholesale and retail trade...............	245.7	10.3	24.2	-	-	1.6	22.6
Wholesale trade..........................	219.6	7.8	18.2	-	-	1.5	16.8
Wholesale trade-durable goods............	193.6	5.9	14.0	-	-	.2	13.8
Wholesale trade-nondurable goods.........	26.0	1.9	4.3	-	-	1.3	3.0
Retail trade.............................	26.0	2.5	5.9	-	-	.1	5.8
Building materials & garden supplies...	2.2	(3)	.2	-	-	.1	.1
General merchandise stores..............	7.1	1.0	1.8	-	-	-	1.8
Food stores..............................	1.6	.2	.5	-	-	-	.5
Automotive dealers and service stations	.5	(3)	(3)	-	-	-	(3)
Apparel and accessory stores............	1.8	(3)	.5	-	-	-	.5
Furniture and homefurnishings stores...	6.4	.4	1.1	-	-	-	1.1
Eating and drinking places..............	.6	(3)	.1	-	-	-	.1
Miscellaneous retail.....................	5.9	.8	1.7	-	-	(3)	1.7

See footnotes at end of table.

TABLE B-2. Scientists, engineers, and technicians in trade and regulated industries, by detailed occupation and broad industry group of employment: 1988--Continued

(numbers of filled jobs in thousands)

Industry	Engineers							
	Total	Aero-nau-tical	Civil	Elec-trical/elec-tronics	Mec-han-ical	Indus-trial	Sales	Other
Total trade and regulated industries	146.5	0.7	7.0	57.8	10.6	7.5	31.4	31.6
Transportation and public utilities	81.5	.7	7.0	39.6	5.3	7.5	-	21.4
Transportation	6.1	.7	.9	.7	.4	.7	-	2.6
Railroad transportation	1.7	-	.7	-	-	-	-	1.0
Local and interurban passenger transit	.1	-	-	-	-	-	-	.1
Trucking and warehousing	-	-	-	-	-	-	-	-
Water transportation	1.0	-	-	-	.2	-	-	.9
Transportation by air	2.5	.7	-	.6	-	.7	-	.5
Pipelines, except natural gas	.7	-	.2	.1	.2	-	-	.2
Transportation services	-	-	-	-	-	-	-	-
Communications	33.1	-	1.9	21.6	.5	2.5	-	6.5
Electric, gas, and sanitary services	42.3	-	4.1	17.3	4.4	4.2	-	12.3
Wholesale and retail trade	65.0	-	-	18.2	5.3	-	31.4	10.2
Wholesale trade	61.2	-	-	17.1	4.8	-	30.0	9.2
Wholesale trade-durable goods	57.3	-	-	16.9	4.1	-	28.5	7.7
Wholesale trade-nondurable goods	3.9	-	-	.2	.7	-	1.5	1.4
Retail trade	3.9	-	-	1.1	.5	-	1.3	1.0
Building materials & garden supplies	.1	-	-	(3)	(3)	-	(3)	.1
General merchandise stores	1.4	-	-	.4	.3	-	.1	.5
Food stores	.1	-	-	(3)	.1	-	-	(3)
Automotive dealers and service stations	.2	-	-	-	-	-	.2	(3)
Apparel and accessory stores	.1	-	-	-	(3)	-	-	(3)
Furniture and homefurnishings stores	1.0	-	-	.4	(3)	-	.5	(3)
Eating and drinking places	.1	-	-	-	(3)	-	-	(3)
Miscellaneous retail	.9	-	-	.2	(3)	-	.4	.2

See footnotes at end of table.

TABLE B-2. Scientists, engineers, and technicians in trade and regulated industries, by detailed occupation and broad industry group of employment: 1988--Continued

(numbers of filled jobs in thousands)

Industry	Technicians							
					Engineering			
	Total	Computer programmer	Drafter	Science	Total	Electrical/electronics	Civil	Other
Total trade and regulated industries.....	270.6	67.4	23.2	7.5	172.4	108.1	4.3	59.9
Transportation and public utilities......	124.5	19.1	16.1	3.4	85.8	31.1	4.3	50.4
Transportation..........................	9.4	4.9	.1	.2	4.1	1.8	.2	2.1
Railroad transportation.................	1.4	.4	-	(3)	1.0	-	.2	.9
Local and interurban passenger transit.	.1	.1	-	-	-	-	-	-
Trucking and warehousing................	2.4	2.4	-	.1	-	-	-	-
Water transportation....................	.1	.1	-	(3)	-	-	-	-
Transportation by air...................	3.6	1.4	-	(3)	2.2	1.4	-	.8
Pipelines, except natural gas...........	1.1	.1	.1	-	.9	.4	.1	.4
Transportation services.................	.6	.5	-	.1	-	-	-	-
Communications..........................	66.5	8.6	5.1	(3)	52.7	16.7	1.9	34.1
Electric, gas, and sanitary services...	48.6	5.6	10.9	3.2	28.9	12.6	2.1	14.2
Wholesale and retail trade..............	146.1	48.3	7.1	4.1	86.6	77.0	-	9.6
Wholesale trade.........................	132.4	39.7	5.0	4.0	83.7	75.6	-	8.1
Wholesale trade-durable goods...........	116.5	30.4	4.7	.8	80.7	73.8	-	6.8
Wholesale trade-nondurable goods........	15.9	9.3	.3	3.2	3.0	1.7	-	1.3
Retail trade............................	13.7	8.6	2.1	.1	2.9	1.5	-	1.4
Building materials & garden supplies...	1.8	.4	1.3	(3)	.1	-	-	.1
General merchandise stores..............	2.9	2.1	.2	(3)	.5	.2	-	.3
Food stores.............................	.8	.5	.1	(3)	.1	.1	-	(3)
Automotive dealers and service stations	.3	.1	-	-	.2	-	-	.2
Apparel and accessory stores............	1.1	.9	(3)	-	.2	-	-	.2
Furniture and homefurnishings stores...	3.9	2.4	.1	-	1.3	.9	-	.4
Eating and drinking places..............	.4	.2	.1	(3)	.1	-	-	.1
Miscellaneous retail....................	2.5	2.0	.1	(3)	.4	.3	-	.1

(1) Scientific, engineering, and technical personnel
(2) Scientific and engineering
(3) Value is less than .05
NOTES: Because of rounding, components may not add to totals.
"-" = No amount available.
n.e.c. = not elsewhere classified.
SOURCES: Bureau of Labor Statistics and National Science Foundation, SRS

B-3. Scientists, engineers, and technicians in each trade and regulated industry as a percent of total employment in the industry and the relative error: 1988

Railroad transportation (SIC 4000)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	4,550	2.46	(1)
Scientists	910	.31	(1)
Operations and systems researchers and analysts	280	.09	17.46
Life scientists, unspecified	10	(2)	34.15
Computer specialists	620	.20	13.97
Managers of scientists and engineers	490	.16	13.27
Engineers	1,720	.56	(1)
Civil	740	.24	10.50
Other, n.e.c	980	.32	(1)
Technicians	1,430	.45	(1)
Computer programmer	390	.12	17.60
Civil engineering technician	170	.05	23.26
All other engineering technicians	860	.28	(1)
Physical and life science technicians	10	(2)	20.82

Local and suburban transportation (4110)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	160	0.27	(1)
Scientists	50	.04	(1)
Computer specialists	50	.04	14.58
Engineers	60	.05	(1)
Other, n.e.c	60	.05	(1)
Technicians	50	.04	(1)
Computer programmer	50	.04	13.14
Physical and life science technicians	(2)	(2)	39.52

School buses (SIC 4150)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	20	(2)	(1)
Scientists	10	(2)	(1)
Computer specialists	10	(2)	25.88
Technicians	10	(2)	(1)
Computer programmer	10	(2)	37.59

Trucking and courier services, ex. air (SIC 4210)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	3,670	0.53	(1)
Scientists	1,000	.07	(1)
Computer specialists	1,000	.07	24.08
Managers of scientists and engineers	450	.03	16.39
Technicians	2,220	.15	(1)
Computer programmer	2,180	.15	18.76
Physical and life science technicians	40	(2)	71.25

See footnotes at end of table.

B-3. Scientists, engineers, and technicians in each trade and regulated industry as a percent of total employment in the industry and the relative error: 1988--Continued

Public warehousing and storage (SIC 4220)

Field	Total	Percent of industry employ-ment	Relative error
Scientists and engineers, total	430	0.88	(1)
Scientists	140	.12	(1)
Life scientists, unspecified	(2)	(2)	67.08
Computer specialists	140	.12	15.09
Managers of scientists and engineers	60	.05	15.27
Technicians	230	.20	(1)
Computer programmer	190	.17	14.04
Physical and life science technicians	40	.03	34.41

Deep sea foreign trans. of freight (SIC 4410)

Field	Total	Percent of industry employ-ment	Relative error
Scientists and engineers, total	330	6.71	(1)
Scientists	100	.55	(1)
Computer specialists	100	.55	22.64
Engineers	230	1.26	(1)
Marine	170	.93	14.22
Mechanical	20	.11	26.14
Other, n.e.c.	40	.22	(1)
Technicians	(2)	(2)	(1)
Physical and life science technicians	(2)	(2)	89.44

Deep sea domestic trans. of freight (SIC 4420)

Field	Total	Percent of industry employ-ment	Relative error
Scientists and engineers, total	180	11.92	(1)
Engineers	180	1.75	(1)
Marine	80	.78	13.58
Mechanical	90	.88	20.68
Other, n.e.c.	10	.09	(1)

Water transportation of freight, nec (SIC 4440)

Field	Total	Percent of industry employ-ment	Relative error
Scientists and engineers, total	140	2.06	(1)
Scientists	20	.15	(1)
Computer specialists	20	.15	24.90
Managers of scientists and engineers	10	.07	34.56
Engineers	100	.74	(1)
Marine	80	.60	14.45
Mechanical	10	.07	37.66
Other, n.e.c.	10	.07	(1)
Technicians	10	.07	(1)
Computer programmer	10	.07	21.54

Water transportation of passengers (SIC 4480)

Field	Total	Percent of industry employ-ment	Relative error
Scientists and engineers, total	70	2.26	(1)
Managers of scientists and engineers	30	.21	22.00
Engineers	20	.14	(1)
Marine	20	.14	23.07
Other, n.e.c.	(2)	(2)	(1)
Technicians	20	.14	(1)
Computer programmer	20	.14	19.82

See footnotes at end of table.

B-3. Scientists, engineers, and technicians in each trade and regulated industry as a percent of total employment in the industry and the relative error: 1988--Continued

Water transportation services (SIC 4490)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	750	1.21	(1)
Scientists	70	.08	(1)
Life scientists, unspecified	10	(2)	33.14
Computer specialists	60	.05	22.16
Managers of scientists and engineers	40	.03	19.04
Engineers	520	.43	(1)
Marine	460	.39	21.81
Mechanical	50	.04	22.38
Other, n.e.c	10	(2)	(1)
Technicians	120	.09	(1)
Computer programmer	100	.08	22.16
Physical and life science technicians	20	.01	58.17

Air transportation, scheduled (SIC 4510)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	8,640	2.76	(1)
Scientists	3,490	.64	(1)
Operations and systems researchers and analysts	1,580	.29	26.84
Life scientists, unspecified	10	(2)	34.64
Computer specialists	1,900	.35	13.86
Managers of scientists and engineers	290	.05	12.40
Engineers	1,860	.32	(1)
Aeronautical	530	.09	(1)
Electrical/electronic	300	.05	18.18
Industrial	630	.11	13.67
Other, n.e.c	400	.07	(1)
Technicians	3,000	.54	(1)
Computer programmer	1,260	.23	15.19
Electrical/electronic technicians	1,200	.22	13.72
All other engineering technicians	530	.09	(1)
Physical and life science technicians	10	(2)	25.55

Air transportation, nonscheduled (SIC 4520)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	140	1.15	(1)
Scientists	10	.05	(1)
Computer specialists	10	.05	27.84
Managers of scientists and engineers	50	.25	28.68
Engineers	20	.10	(1)
Other, n.e.c	20	.10	(1)
Technicians	60	.30	(1)
Computer programmer	50	.25	17.50
All other engineering technicians	10	.05	(1)

Airports, flying fields, and services (SIC 4580)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	1,390	2.40	(1)
Scientists	70	.07	(1)
Operations and systems researchers and analysts	40	.04	17.96
Life scientists, unspecified	(2)	(2)	(1)
Computer specialists	30	.03	18.87
Managers of scientists and engineers	70	.07	15.29
Engineers	660	.72	(1)
Aeronautical	150	.16	(1)
Electrical/electronic	300	.33	30.69
Industrial	120	.13	21.77
Other, n.e.c	90	.10	(1)
Technicians	590	.64	(1)
Computer programmer	70	.07	24.97
Electrical/electronic technicians	200	.22	21.10
All other engineering technicians	300	.33	(1)
Physical and life science technicians	20	.02	57.60

See footnotes at end of table.

B-3. Scientists, engineers, and technicians in each trade and regulated industry as a percent of total employment in the industry and the relative error: 1988--Continued

Pipelines, except natural gas (SIC 4610)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	2,010	15.51	(1)
Scientists	120	.73	(1)
Life scientists, unspecified	10	.05	25.71
Computer specialists	110	.58	15.79
Managers of scientists and engineers	100	.53	12.44
Engineers	690	3.67	(1)
Civil	180	.96	13.55
Electrical/electronic	130	.69	14.44
Mechanical	220	1.17	11.06
Other, n.e.c	160	.85	(1)
Technicians	1,100	5.86	(1)
Computer programmer	70	.37	19.11
Drafter	150	.80	10.26
Electrical/electronic technicians	380	2.03	8.45
Mechanical engineering technician	210	1.12	12.29
Civil engineering technician	80	.42	14.81
All other engineering technicians	210	1.12	(1)
Physical and life science technicians	(2)	(2)	52.44

Freight transportation arrangement (SIC 4730)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	780	1.58	(1)
Scientists	290	.25	(1)
Computer specialists	290	.25	12.76
Managers of scientists and engineers	50	.04	20.95
Technicians	440	.38	(1)
Computer programmer	440	.38	11.58

Rental of railroad cars (SIC 4740)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	30	7.62	(1)
Technicians	30	.88	(1)
Computer programmer	30	.88	44.94

Miscellaneous transportation services (SIC 4780)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	100	1.72	(1)
Scientists	10	.28	(1)
Computer specialists	10	.05	24.56
Technicians	90	.52	(1)
Computer programmer	30	.17	22.45
Physical and life science technicians	60	.35	26.90

See footnotes at end of table.

B-3. Scientists, engineers, and technicians in each trade and regulated industry as a percent of total employment in the industry and the relative error: 1988--Continued

Telephone communications (SIC 4810)

Field	Total	Percent of industry employ-ment	Relative error
Scientists and engineers, total	71,050	13.31	(1)
Scientists	11,420	1.28	(1)
Computer specialists	11,420	1.28	6.34
Managers of scientists and engineers	3,630	.40	8.22
Engineers	27,020	3.00	(1)
Civil	1,860	.20	10.91
Electrical/electronic	16,430	1.84	6.91
Industrial	2,300	.25	14.96
Mechanical	280	.03	16.53
Other, n.e.c	6,150	.68	(1)
Technicians	28,980	3.23	(1)
Computer programmer	7,760	.87	9.81
Drafter	4,020	.45	8.26
Electrical/electronic technicians	10,680	1.19	7.18
Mechanical engineering technician	310	.03	31.56
Civil engineering technician	1,920	.21	17.34
All other engineering technicians	4,290	.48	(1)
Physical and life science technicians	(2)	(2)	74.02

Telegraph & other communications (SIC 4820)

Field	Total	Percent of industry employ-ment	Relative error
Scientists and engineers, total	1,530	12.67	(1)
Scientists	90	.52	(1)
Computer specialists	90	.52	37.39
Managers of scientists and engineers	220	1.27	22.28
Engineers	540	3.12	(1)
Electrical/electronic	500	2.89	18.58
Other, n.e.c	40	.23	(1)
Technicians	680	3.91	(1)
Drafter	20	.11	30.68
Electrical/electronic technicians	440	2.54	22.50
Broadcast technician	80	.46	41.47
All other engineering technicians	120	.69	(1)
Physical and life science technicians	20	.11	67.71

Radio and television broadcasting (SIC 4830)

Field	Total	Percent of industry employ-ment	Relative error
Scientists and engineers, total	32,770	15.76	(1)
Scientists	260	.11	(1)
Computer specialists	260	.11	28.57
Managers of scientists and engineers	1,430	.62	5.39
Engineers	2,850	1.22	(1)
Civil	60	.02	48.63
Electrical/electronic	2,410	1.05	7.46
Industrial	80	.03	22.43
Mechanical	150	.06	19.05
Other, n.e.c	150	.06	(1)
Technicians	28,230	12.30	(1)
Computer programmer	200	.08	17.14
Drafter	20	(2)	22.63
Electrical/electronic technicians	1,920	.83	6.70
Mechanical engineering technician	80	.03	30.27
Broadcast technician	25,330	11.07	6.42
All other engineering technicians	680	.29	(1)

See footnotes at end of table.

B-3. Scientists, engineers, and technicians in each trade and regulated industry as a percent of total employment in the industry and the relative error: 1988--Continued

Cable and other pay TV services (SIC 4840)

Field	Total	Percent of industry employ-ment	Relative error
Scientists and engineers, total	6,720	7.34	(1)
Scientists	250	.22	(1)
Computer specialists	250	.22	22.71
Managers of scientists and engineers	590	.52	8.51
Engineers	950	.83	(1)
Civil	20	.01	37.35
Electrical/electronic	610	.54	13.39
Industrial	90	.08	19.39
Mechanical	40	.03	38.22
Other, n.e.c	190	.17	(1)
Technicians	4,930	4.38	(1)
Computer programmer	280	.25	21.54
Drafter	440	.39	7.92
Electrical/electronic technicians	1,720	1.54	10.57
Mechanical engineering technician	20	.01	48.07
Broadcast technician	1,950	1.75	8.84
Civil engineering technician	20	.01	35.00
All other engineering technicians	490	.43	(1)
Physical and life science technicians	10	(2)	68.46

Communication services, n.e.c. (SIC 4890)

Field	Total	Percent of industry employ-ment	Relative error
Scientists and engineers, total	5,930	31.61	(1)
Scientists	320	1.43	(1)
Computer specialists	320	1.18	24.84
Managers of scientists and engineers	210	.77	21.03
Engineers	1,740	6.43	(1)
Electrical/electronic	1,640	6.07	16.72
Industrial	60	.22	37.57
Mechanical	20	.07	52.82
Other, n.e.c	20	.07	(1)
Technicians	3,660	13.52	(1)
Computer programmer	370	1.37	42.60
Drafter	600	2.22	42.39
Electrical/electronic technicians	1,960	7.25	33.74
Mechanical engineering technician	10	.03	42.45
Broadcast technician	440	1.62	30.60
All other engineering technicians	280	1.03	(1)
Physical and life science technicians	(2)	(2)	75.09

Electric services (SIC 4910)

Field	Total	Percent of industry employ-ment	Relative error
Scientists and engineers, total	67,440	23.55	(1)
Scientists	7,430	1.89	(1)
Mathematical scientists	1,220	.27	27.48
Geologists, geophysicists, and earth scientists	90	.02	10.52
All other physical scientists	1,000	.22	(1)
Life scientists, unspecified	740	.16	13.80
Computer specialists	4,380	.98	5.89
Managers of scientists and engineers	4,380	.98	5.53
Engineers	27,120	6.08	(1)
Chemical	580	.13	7.81
Civil	1,920	.43	7.60
Electrical/electronic	12,890	2.90	5.35
Industrial	3,200	.72	11.20
Mechanical	2,580	.58	6.95
Safety	790	.17	6.88
Nuclear	3,040	.68	7.39
Other, n.e.c	2,120	.47	(1)
Technicians	28,510	6.37	(1)
Computer programmer	2,720	.61	6.54
Drafter	2,710	.61	8.06
Electrical/electronic technicians	7,640	1.71	5.68
Surveyor	470	.10	7.13
Surveying and mapping technicians	1,100	.24	7.04
Mechanical engineering technician	1,160	.26	8.21
Civil engineering technician	1,090	.24	9.47
Estimator and drafter, utilities	3,850	.86	5.85
All other engineering technicians	5,300	1.19	(1)
Physical and life science technicians	2,470	.55	8.12

See footnotes at end of table.

B-3. Scientists, engineers, and technicians in each trade and regulated industry as a percent of total employment in the industry and the relative error: 1988--Continued

Gas production and distribution (SIC 4920)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	11,600	10.87	(1)
Scientists	1,790	1.19	(1)
Mathematical scientists	180	.11	24.17
Geologists, geophysicists, and earth scientists	160	.09	20.04
All other physical scientists	20	.01	(1)
Life scientists, unspecified	20	.01	44.16
Computer specialists	1,410	.87	9.85
Managers of scientists and engineers	1,130	.69	8.68
Engineers	2,840	1.72	(1)
Chemical	220	.13	16.56
Civil	820	.50	8.95
Electrical/electronic	300	.18	12.68
Industrial	340	.21	12.80
Mechanical	490	.30	13.65
Safety	140	.08	13.90
Other, n.e.c.	530	.32	(1)
Technicians	5,840	3.55	(1)
Computer programmer	1,230	.75	10.22
Drafter	1,100	.67	6.48
Electrical/electronic technicians	570	.35	14.00
Surveyor	110	.06	14.32
Surveying and mapping technicians	260	.16	10.91
Mechanical engineering technician	400	.24	14.35
Civil engineering technician	410	.25	9.69
Estimator and drafter, utilities	220	.13	19.45
All other engineering technicians	1,500	.92	(1)
Physical and life science technicians	40	.02	25.96

Combination utility services (SIC 4930)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	28,280	22.83	(1)
Scientists	2,750	1.51	(1)
Mathematical scientists	220	.11	19.39
Geologists, geophysicists, and earth scientists	40	.02	17.20
All other physical scientists	210	.10	(1)
Life scientists, unspecified	110	.05	19.42
Computer specialists	2,170	1.11	11.37
Managers of scientists and engineers	1,230	.63	7.33
Engineers	11,500	5.88	(1)
Chemical	260	.13	8.84
Civil	1,010	.52	8.34
Electrical/electronic	4,090	2.10	7.66
Industrial	640	.32	10.67
Mechanical	1,280	.65	9.02
Safety	250	.12	20.29
Nuclear	1,090	.56	12.74
Other, n.e.c.	2,880	1.48	(1)
Technicians	12,800	6.53	(1)
Computer programmer	1,530	.78	9.84
Drafter	1,320	.67	9.04
Electrical/electronic technicians	4,340	2.23	21.55
Surveyor	170	.08	12.12
Surveying and mapping technicians	420	.21	7.46
Mechanical engineering technician	590	.30	13.90
Civil engineering technician	510	.26	13.72
Estimator and drafter, utilities	1,390	.71	6.21
All other engineering technicians	2,290	1.17	(1)
Physical and life science technicians	240	.12	18.72

See footnotes at end of table.

B-3. Scientists, engineers, and technicians in each trade and regulated industry as a percent of total employment in the industry and the relative error: 1988--Continued

Water supply (SIC 4940)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	970	5.88	(1)
Scientists	160	1.16	(1)
All other physical scientists	120	.50	(1)
Life scientists, unspecified	(2)	(2)	33.46
Computer specialists	40	.16	12.19
Managers of scientists and engineers	140	.58	11.74
Engineers	240	.99	(1)
Civil	200	.83	10.54
Electrical/electronic	10	.04	21.21
Industrial	10	.04	18.16
Mechanical	10	.04	19.54
Safety	(2)	(2)	44.72
Other, n.e.c	10	.04	(1)
Technicians	430	1.76	(1)
Computer programmer	40	.16	13.15
Drafter	90	.37	10.32
Electrical/electronic technicians	10	.04	23.71
Surveyor	10	.04	32.26
Surveying and mapping technicians	20	.08	17.67
Civil engineering technician	40	.16	13.15
Estimator and drafter, utilities	60	.25	13.50
All other engineering technicians	60	.25	(1)
Physical and life science technicians	100	.41	16.27

Sanitary services (SIC 4950)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	2,700	4.14	(1)
Scientists	530	1.04	(1)
Geologists, geophysicists, and earth scientists	110	.11	21.14
All other physical scientists	340	.37	(1)
Life scientists, unspecified	40	.04	31.96
Computer specialists	40	.04	14.31
Managers of scientists and engineers	570	.62	12.37
Engineers	620	.65	(1)
Chemical	150	.16	20.56
Civil	190	.20	18.70
Electrical/electronic	10	.01	40.74
Industrial	20	.02	26.76
Mechanical	40	.04	23.08
Safety	90	.09	14.49
Other, n.e.c	120	.13	(1)
Technicians	980	1.03	(1)
Computer programmer	80	.08	16.96
Drafter	70	.07	17.38
Electrical/electronic technicians	40	.04	25.01
Surveyor	40	.04	51.96
Surveying and mapping technicians	10	.01	38.34
Mechanical engineering technician	10	.01	41.09
Civil engineering technician	80	.08	28.47
Estimator and drafter, utilities	50	.05	29.29
All other engineering technicians	250	.27	(1)
Physical and life science technicians	350	.38	15.47

Steam and air-conditioning supply (SIC 4960)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	60	3.99	(1)
Scientists	(2)	(2)	(1)
Mathematical scientists	(2)	(2)	86.96
Managers of scientists and engineers	50	3.33	21.55
Engineers	(2)	(2)	(1)
Other, n.e.c	(2)	(2)	(1)
Technicians	10	.66	(1)
Estimator and drafter, utilities	10	.66	42.66
All other engineering technicians	(2)	(2)	(1)

See footnotes at end of table.

B-3. Scientists, engineers, and technicians in each trade and regulated industry as a percent of total employment in the industry and the relative error: 1988--Continued

Irrigation systems (SIC 4970)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	20	1.00	(1)
Managers of scientists and engineers	10	.50	74.64
Engineers	(2)	(2)	(1)
Other, n.e.c	(2)	(2)	(1)
Technicians	10	.50	(1)
All other engineering technicians	10	.50	(1)
Physical and life science technicians	(2)	(2)	83.66

Motor vehicles, parts, and supplies (SIC 5010)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	6,270	2.20	(1)
Scientists	400	.08	(1)
Life scientists, unspecified	(2)	(2)	79.05
Computer specialists	400	.08	13.68
Managers of scientists and engineers	250	.05	14.40
Engineers	2,620	.56	(1)
Electrical/electronic	140	.03	33.91
Mechanical	200	.04	21.60
Sales	230	.05	24.59
Other, n.e.c	2,050	.44	(1)
Technicians	3,000	.63	(1)
Computer programmer	1,220	.26	7.53
Electrical/electronic technicians	940	.20	19.18
Mechanical engineering technician	30	(2)	25.00
All other engineering technicians	760	.16	(1)
Physical and life science technicians	50	.01	48.72

Furniture and homefurnishings (SIC 5020)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	930	0.98	(1)
Scientists	90	.05	(1)
Computer specialists	90	.05	20.50
Managers of scientists and engineers	30	.01	20.17
Engineers	60	.02	(1)
Mechanical	10	(2)	41.64
Sales	40	.02	68.09
Other, n.e.c	10	(2)	(1)
Technicians	750	.47	(1)
Computer programmer	480	.31	8.85
Drafter	180	.11	20.81
Electrical/electronic technicians	80	.05	64.10
All other engineering technicians	10	(2)	(1)

Lumber and construction materials (SIC 5030)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	1,550	0.95	(1)
Scientists	90	.03	(1)
Life scientists, unspecified	(2)	(2)	93.54
Computer specialists	90	.03	18.95
Managers of scientists and engineers	60	.02	20.56
Engineers	230	.08	(1)
Mechanical	20	(2)	41.00
Sales	90	.03	45.56
Other, n.e.c	120	.05	(1)
Technicians	1,170	.49	(1)
Computer programmer	510	.22	10.55
Drafter	370	.16	18.21
Electrical/electronic technicians	150	.06	20.57
All other engineering technicians	30	.01	(1)
Physical and life science technicians	110	.04	67.10

See footnotes at end of table.

B-3. Scientists, engineers, and technicians in each trade and regulated industry as a percent of total employment in the industry and the relative error: 1988--Continued

Professional & commercial equipment (SIC 5040)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	101,100	18.84	(1)
Scientists	8,090	1.07	(1)
Life scientists, unspecified	120	.01	82.65
Computer specialists	7,970	1.05	12.54
Managers of scientists and engineers	2,420	.32	11.10
Engineers	31,900	4.20	(1)
Electrical/electronic	11,000	1.45	19.18
Mechanical	580	.07	34.14
Sales	17,560	2.32	26.11
Other, n.e.c	2,760	.36	(1)
Technicians	58,690	7.74	(1)
Computer programmer	18,670	2.47	17.89
Drafter	640	.08	36.33
Electrical/electronic technicians	36,560	4.84	8.74
Mechanical engineering technician	740	.09	54.64
All other engineering technicians	1,720	.22	(1)
Physical and life science technicians	360	.04	68.60

Metals and minerals, except petroleum (SIC 5050)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	1,710	1.80	(1)
Scientists	140	.10	(1)
Computer specialists	140	.09	13.90
Managers of scientists and engineers	140	.09	17.69
Engineers	380	.25	(1)
Electrical/electronic	40	.02	34.89
Mechanical	90	.06	24.96
Sales	90	.06	53.39
Other, n.e.c	160	.11	(1)
Technicians	1,050	.72	(1)
Computer programmer	440	.31	11.08
Drafter	360	.25	22.40
Electrical/electronic technicians	150	.10	35.14
Mechanical engineering technician	20	.01	38.62
All other engineering technicians	60	.04	(1)
Physical and life science technicians	20	.01	56.39

Electrical goods (SIC 5060)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	45,430	11.61	(1)
Scientists	3,470	.69	(1)
Life scientists, unspecified	10	(2)	61.56
Computer specialists	3,460	.69	12.95
Managers of scientists and engineers	1,810	.36	9.93
Engineers	11,040	2.18	(1)
Electrical/electronic	4,770	.95	12.12
Mechanical	600	.11	19.61
Sales	4,920	.98	11.94
Other, n.e.c	750	.14	(1)
Technicians	29,110	5.77	(1)
Computer programmer	3,250	.64	10.48
Drafter	470	.09	19.56
Electrical/electronic technicians	24,050	4.79	5.40
Mechanical engineering technician	380	.07	20.82
All other engineering technicians	940	.18	(1)
Physical and life science technicians	20	(2)	44.07

See footnotes at end of table.

B-3. Scientists, engineers, and technicians in each trade and regulated industry as a percent of total employment in the industry and the relative error: 1988--Continued

Hardware, plumbing & heating equipment (SIC 5070)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	5,730	2.70	(1)
Scientists	180	.06	(1)
Computer specialists	180	.06	12.12
Managers of scientists and engineers	200	.07	22.57
Engineers	1,950	.67	(1)
Electrical/electronic	140	.04	26.70
Mechanical	260	.09	29.46
Sales	1,260	.44	17.70
Other, n.e.c	290	.10	(1)
Technicians	3,400	1.17	(1)
Computer programmer	1,100	.39	8.17
Drafter	760	.26	32.65
Electrical/electronic technicians	1,310	.46	13.58
Mechanical engineering technician	50	.01	73.10
All other engineering technicians	160	.05	(1)
Physical and life science technicians	20	(2)	69.76

Machinery, equipment, and supplies (SIC 5080)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	28,520	4.70	(1)
Scientists	1,340	.18	(1)
Life scientists, unspecified	10	(2)	(1)
Computer specialists	1,330	.16	37.70
Managers of scientists and engineers	840	.10	18.77
Engineers	8,790	1.07	(1)
Electrical/electronic	780	.09	25.66
Mechanical	2,270	.28	22.57
Sales	4,230	.52	18.46
Other, n.e.c	1,510	.18	(1)
Technicians	17,550	2.14	(1)
Computer programmer	3,760	.46	14.39
Drafter	1,820	.22	30.97
Electrical/electronic technicians	9,940	1.23	12.38
Mechanical engineering technician	770	.09	38.26
All other engineering technicians	1,100	.13	(1)
Physical and life science technicians	160	.01	58.17

Miscellaneous durable goods (SIC 5090)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	2,410	1.24	(1)
Scientists	170	.07	(1)
Life scientists, unspecified	60	.02	78.11
Computer specialists	110	.03	23.76
Managers of scientists and engineers	160	.05	21.17
Engineers	300	.09	(1)
Electrical/electronic	60	.02	39.96
Mechanical	70	.02	20.81
Sales	80	.02	35.31
Other, n.e.c	90	.03	(1)
Technicians	1,780	.58	(1)
Computer programmer	960	.32	8.37
Drafter	60	.02	31.13
Electrical/electronic technicians	670	.22	19.31
Mechanical engineering technician	30	.01	57.02
All other engineering technicians	40	.01	(1)
Physical and life science technicians	20	(2)	60.32

See footnotes at end of table.

B-3. Scientists, engineers, and technicians in each trade and regulated industry as a percent of total employment in the industry and the relative error: 1988--Continued

Paper and paper products (SIC 5110)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	1,500	1.12	(1)
Scientists	150	.06	(1)
Computer specialists	150	.06	13.96
Managers of scientists and engineers	60	.02	23.66
Engineers	160	.05	(1)
Mechanical	20	(2)	24.13
Sales	110	.04	61.58
Other, n.e.c	30	.01	(1)
Technicians	1,130	.50	(1)
Computer programmer	760	.34	11.94
Drafter	30	.01	33.30
Electrical/electronic technicians	250	.11	27.83
All other engineering technicians	90	.04	(1)

Drugs, proprietaries, and sundries (SIC 5120)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	3,750	3.02	(1)
Scientists	1,060	.68	(1)
Life scientists, unspecified	590	.31	24.99
Computer specialists	470	.25	11.93
Managers of scientists and engineers	340	.18	15.12
Engineers	240	.11	(1)
Mechanical	50	.02	26.43
Sales	50	.02	48.56
Other, n.e.c	140	.07	(1)
Technicians	2,110	1.11	(1)
Computer programmer	950	.50	9.78
Drafter	20	.01	29.32
Electrical/electronic technicians	80	.04	46.98
Mechanical engineering technician	40	.02	39.32
All other engineering technicians	80	.04	(1)
Physical and life science technicians	940	.50	17.64

Apparel, piece goods, and notions (SIC 5130)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	1,610	1.59	(1)
Scientists	280	.14	(1)
Life scientists, unspecified	(2)	(2)	89.44
Computer specialists	280	.14	25.98
Managers of scientists and engineers	90	.04	27.18
Engineers	80	.03	(1)
Electrical/electronic	10	(2)	50.30
Mechanical	10	(2)	58.09
Other, n.e.c	60	.03	(1)
Technicians	1,160	.58	(1)
Computer programmer	1,080	.55	13.42
Electrical/electronic technicians	10	(2)	(1)
All other engineering technicians	70	.03	(1)

See footnotes at end of table.

B-3. Scientists, engineers, and technicians in each trade and regulated industry as a percent of total employment in the industry and the relative error: 1988--Continued

Groceries and related products (SIC 5140)

Field	Total	Percent of industry employ- ment	Relative error
Scientists and engineers, total	5,730	1.21	(1)
Scientists	960	.12	(1)
Life scientists, unspecified	40	(2)	50.82
Computer specialists	920	.11	8.65
Managers of scientists and engineers	440	.05	9.94
Engineers	530	.05	(1)
Electrical/electronic	100	.01	17.42
Mechanical	230	.02	16.94
Sales	90	.01	25.19
Other, n.e.c	110	.01	(1)
Technicians	3,800	.43	(1)
Computer programmer	2,760	.33	7.82
Drafter	110	.01	19.79
Electrical/electronic technicians	290	.03	40.69
Mechanical engineering technician	50	(2)	28.73
All other engineering technicians	100	.01	(1)
Physical and life science technicians	490	.05	27.13

Farm-product raw materials (SIC 5150)

Field	Total	Percent of industry employ- ment	Relative error
Scientists and engineers, total	860	1.04	(1)
Scientists	150	.16	(1)
Life scientists, unspecified	50	.03	55.30
Computer specialists	100	.07	23.69
Managers of scientists and engineers	60	.04	17.22
Engineers	40	.01	(1)
Electrical/electronic	10	(2)	36.17
Mechanical	20	.01	19.85
Other, n.e.c	10	(2)	(1)
Technicians	610	.45	(1)
Computer programmer	370	.28	11.40
Electrical/electronic technicians	80	.06	26.17
All other engineering technicians	20	.01	(1)
Physical and life science technicians	140	.10	50.73

Chemicals and allied products (SIC 5160)

Field	Total	Percent of industry employ- ment	Relative error
Scientists and engineers, total	3,800	4.47	(1)
Scientists	440	.89	(1)
Life scientists, unspecified	180	.13	25.47
Computer specialists	260	.20	23.10
Managers of scientists and engineers	400	.31	30.37
Engineers	1,200	.97	(1)
Electrical/electronic	40	.03	31.28
Mechanical	100	.07	23.44
Sales	780	.60	24.17
Other, n.e.c	360	.27	(1)
Technicians	1,760	1.33	(1)
Computer programmer	430	.33	10.79
Drafter	40	.03	27.01
Electrical/electronic technicians	270	.20	23.20
Mechanical engineering technician	30	.02	33.80
All other engineering technicians	270	.20	(1)
Physical and life science technicians	720	.55	18.18

See footnotes at end of table.

B-3. Scientists, engineers, and technicians in each trade and regulated industry as a percent of total employment in the industry and the relative error: 1988--Continued

Petroleum and petroleum products (SIC 5170)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	3,510	2.70	(1)
Scientists	270	.21	(1)
Computer specialists	270	.13	14.73
Managers of scientists and engineers	280	.13	14.39
Engineers	1,380	.65	(1)
Electrical/electronic	20	(2)	32.77
Mechanical	260	.12	15.88
Sales	430	.21	23.26
Other, n.e.c	670	.32	(1)
Technicians	1,580	.75	(1)
Computer programmer	750	.36	15.90
Drafter	70	.03	23.05
Electrical/electronic technicians	150	.07	26.22
All other engineering technicians	290	.14	(1)
Physical and life science technicians	320	.15	30.42

Beer, wine, and distilled beverages (SIC 5180)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	590	0.80	(1)
Scientists	70	.04	(1)
Computer specialists	70	.04	12.68
Managers of scientists and engineers	10	(2)	20.20
Engineers	(2)	(2)	(1)
Other, n.e.c	(2)	(2)	(1)
Technicians	510	.33	(1)
Computer programmer	490	.32	9.28
All other engineering technicians	20	.01	(1)

Misc. nondurable goods (SIC 5190)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	4,560	1.46	(1)
Scientists	900	.22	(1)
Life scientists, unspecified	400	.08	21.73
Computer specialists	500	.10	11.49
Managers of scientists and engineers	240	.05	20.97
Engineers	180	.01	(1)
Electrical/electronic	30	(2)	34.16
Mechanical	20	(2)	37.98
Sales	90	.01	51.78
Other, n.e.c	40	(2)	(1)
Technicians	3,240	.67	(1)
Computer programmer	1,730	.37	7.75
Drafter	50	.01	39.27
Electrical/electronic technicians	580	.12	37.68
Mechanical engineering technician	30	(2)	(1)
All other engineering technicians	210	.04	(1)
Physical and life science technicians	640	.13	27.24

See footnotes at end of table.

B-3. Scientists, engineers, and technicians in each trade and regulated industry as a percent of total employment in the industry and the relative error: 1988--Continued

Lumber and other building materials (SIC 5210)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	1,710	0.47	(1)
Scientists	150	.02	(1)
Life scientists, unspecified	20	(2)	(1)
Computer specialists	130	.02	19.30
Engineers	120	.01	(1)
Electrical/electronic	10	(2)	53.61
Mechanical	10	(2)	43.69
Sales	40	(2)	47.02
Other, n.e.c	60	.01	(1)
Technicians	1,440	.30	(1)
Computer programmer	240	.05	16.63
Drafter	1,130	.24	11.58
Mechanical engineering technician	10	(2)	38.32
All other engineering technicians	60	.01	(1)

Paint, glass, and wallpaper stores (SIC 5230)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	110	0.16	(1)
Scientists	(2)	.01	(1)
Computer specialists	(2)	(2)	36.51
Engineers	(2)	(2)	(1)
Other, n.e.c	(2)	(2)	(1)
Technicians	110	.13	(1)
Computer programmer	20	.02	26.55
Drafter	70	.09	20.16
All other engineering technicians	10	.01	(1)
Physical and life science technicians	10	.01	50.91

Hardware stores (SIC 5250)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	130	0.22	(1)
Scientists	(2)	(2)	(1)
Engineers	(2)	(2)	(1)
Other, n.e.c	(2)	(2)	(1)
Technicians	130	.07	(1)
Computer programmer	90	.05	24.75
Drafter	40	.02	38.88
All other engineering technicians	(2)	(2)	(1)
Physical and life science technicians	(2)	(2)	46.90

Retail nurseries and garden stores (SIC 5260)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	230	0.26	(1)
Scientists	60	.06	(1)
Life scientists, unspecified	60	.06	23.67
Managers of scientists and engineers	10	.01	61.36
Engineers	20	.02	(1)
Other, n.e.c	20	.02	(1)
Technicians	140	.14	(1)
Computer programmer	10	.01	44.49
Drafter	110	.11	14.59
All other engineering technicians	10	.01	(1)
Physical and life science technicians	10	.01	70.28

See footnotes at end of table.

B-3. Scientists, engineers, and technicians in each trade and regulated industry as a percent of total employment in the industry and the relative error: 1988--Continued

Mobile home dealers (SIC 5270)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	10	0.09	(1)
Technicians	10	.03	(1)
All other engineering technicians	10	.03	(1)

Department stores (SIC 5310)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	6,530	0.54	(1)
Scientists	1,780	.09	(1)
Computer specialists	1,780	.09	23.77
Managers of scientists and engineers	930	.04	21.18
Engineers	1,330	.05	(1)
Electrical/electronic	450	.02	29.17
Mechanical	280	.01	10.94
Sales	150	(2)	30.74
Other, n.e.c.	450	.02	(1)
Technicians	2,490	.10	(1)
Computer programmer	1,880	.09	32.79
Drafter	220	.01	16.26
Electrical/electronic technicians	30	(2)	41.90
Mechanical engineering technician	160	(2)	19.31
All other engineering technicians	160	(2)	(1)
Physical and life science technicians	40	(2)	57.52

Variety stores (SIC 5330)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	150	0.19	(1)
Scientists	(2)	(2)	(1)
Managers of scientists and engineers	40	.01	38.12
Engineers	10	(2)	(1)
Other, n.e.c.	10	(2)	(1)
Technicians	100	.04	(1)
Computer programmer	100	.04	26.53
All other engineering technicians	(2)	(2)	(1)

Misc. general merchandise stores (SIC 5390)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	390	0.33	(1)
Managers of scientists and engineers	10	(2)	39.13
Engineers	60	.02	(1)
Other, n.e.c.	60	.02	(1)
Technicians	320	.12	(1)
Computer programmer	130	.05	30.78
Drafter	20	(2)	44.47
Electrical/electronic technicians	160	.07	59.43
All other engineering technicians	10	(2)	(1)

See footnotes at end of table.

B-3. Scientists, engineers, and technicians in each trade and regulated industry as a percent of total employment in the industry and the relative error: 1988--Continued

Grocery stores (SIC 5410)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	1,560	0.04	(1)
Scientists	460	.01	(1)
Life scientists, unspecified	(2)	(2)	(1)
Computer specialists	460	.01	51.86
Managers of scientists and engineers	190	(2)	42.00
Engineers	150	(2)	(1)
Electrical/electronic	40	(2)	67.31
Mechanical	80	(2)	80.03
Other, n.e.c	30	(2)	(1)
Technicians	760	.01	(1)
Computer programmer	520	.01	28.04
Drafter	120	(2)	48.31
Electrical/electronic technicians	70	(2)	79.69
Mechanical engineering technician	10	(2)	61.16
All other engineering technicians	30	(2)	(1)
Physical and life science technicians	10	(2)	83.36

Candy, nut, and confectionery stores (SIC 5440)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	10	0.06	(1)
Scientists	(2)	(2)	(1)
Life scientists, unspecified	(2)	(2)	64.71
Technicians	10	.03	(1)
Computer programmer	10	.03	33.14

Miscellaneous food stores (SIC 5490)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	10	0.04	(1)
Scientists	10	.02	(1)
Computer specialists	10	.02	39.38
Engineers	(2)	(2)	(1)
Other, n.e.c	(2)	(2)	(1)
Technicians	(2)	(2)	(1)
Physical and life science technicians	(2)	(2)	75.82

Auto and home supply stores (SIC 5530)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	200	0.06	(1)
Scientists	10	(2)	(1)
Computer specialists	10	(2)	31.51
Managers of scientists and engineers	10	(2)	38.52
Engineers	(2)	(2)	(1)
Other, n.e.c	(2)	(2)	(1)
Technicians	180	.04	(1)
Computer programmer	100	.02	29.17
All other engineering technicians	80	.02	(1)

See footnotes at end of table.

B-3. Scientists, engineers, and technicians in each trade and regulated industry as a percent of total employment in the industry and the relative error: 1988--Continued

Gasoline service stations (SIC 5540)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	220	0.02	(1)
Scientists	(2)	(2)	(1)
Engineers	180	.02	(1)
Sales	160	.02	70.77
Other, n.e.c	20	(2)	(1)
Technicians	40	(2)	(1)
Computer programmer	10	(2)	71.07
All other engineering technicians	30	(2)	(1)
Physical and life science technicians	(2)	(2)	74.16

Boat dealers (SIC 5550)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	20	0.04	(1)
Technicians	20	.04	(1)
All other engineering technicians	20	.04	(1)

Automotive dealers, n.e.c. (SIC 5590)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	30	0.50	(1)
Engineers	(2)	(2)	(1)
Other, n.e.c	(2)	(2)	(1)
Technicians	30	.30	(1)
Computer programmer	(2)	(2)	52.70
All other engineering technicians	30	.30	(1)

Men's and boys' clothing stores (SIC 5610)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	90	0.10	(1)
Scientists	20	.01	(1)
Computer specialists	20	.01	29.47
Managers of scientists and engineers	10	(2)	28.97
Technicians	60	.04	(1)
Computer programmer	50	.04	17.86
All other engineering technicians	10	(2)	(1)

Women's clothing stores (SIC 5620)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	590	0.30	(1)
Scientists	170	.04	(1)
Computer specialists	170	.04	23.63
Engineers	(2)	(2)	(1)
Other, n.e.c	(2)	(2)	(1)
Technicians	420	.09	(1)
Computer programmer	380	.09	23.56
All other engineering technicians	40	(2)	(1)

See footnotes at end of table.

B-3. Scientists, engineers, and technicians in each trade and regulated industry as a percent of total employment in the industry and the relative error: 1988--Continued

Women's accessory and specialty stores (SIC 5630)

Field	Total	Percent of industry employ-ment	Relative error
Scientists and engineers, total	10	0.04	(1)
Technicians	10	.02	(1)
Computer programmer	10	.02	33.64

Children's and infants" wear stores (SIC 5640)

Field	Total	Percent of industry employ-ment	Relative error
Scientists and engineers, total	30	0.40	(1)
Scientists	(2)	(2)	(1)
Life scientists, unspecified	(2)	(2)	67.08
Engineers	10	.02	(1)
Other, n.e.c	10	.02	(1)
Technicians	20	.05	(1)
Computer programmer	20	.05	29.71

Family clothing stores (SIC 5650)

Field	Total	Percent of industry employ-ment	Relative error
Scientists and engineers, total	600	0.35	(1)
Scientists	180	.06	(1)
Computer specialists	180	.06	26.16
Managers of scientists and engineers	40	.01	20.38
Engineers	40	(2)	(1)
Mechanical	20	(2)	34.11
Other, n.e.c	20	(2)	(1)
Technicians	340	.11	(1)
Computer programmer	260	.09	18.81
Drafter	20	(2)	41.57
All other engineering technicians	60	.02	(1)

Shoe stores (SIC 5660)

Field	Total	Percent of industry employ-ment	Relative error
Scientists and engineers, total	400	0.30	(1)
Scientists	130	.05	(1)
Computer specialists	130	.05	28.25
Engineers	10	(2)	(1)
Other, n.e.c	10	(2)	(1)
Technicians	260	.10	(1)
Computer programmer	180	.07	25.94
All other engineering technicians	80	.03	(1)

Misc. apparel and accessory stores (SIC 5690)

Field	Total	Percent of industry employ-ment	Relative error
Scientists and engineers, total	40	0.09	(1)
Engineers	10	.01	(1)
Other, n.e.c	10	.01	(1)
Technicians	30	.04	(1)
Computer programmer	20	.03	32.17
All other engineering technicians	10	.01	(1)

See footnotes at end of table.

B-3. Scientists, engineers, and technicians in each trade and regulated industry as a percent of total employment in the industry and the relative error: 1988--Continued

Furniture and homefurnishings stores (SIC 5710)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	550	0.19	(1)
Scientists	100	.02	(1)
Computer specialists	100	.02	15.64
Managers of scientists and engineers	20	(2)	28.98
Engineers	10	(2)	(1)
Electrical/electronic	10	(2)	39.87
Other, n.e.c	(2)	(2)	(1)
Technicians	420	.08	(1)
Computer programmer	260	.05	15.82
Drafter	140	.03	36.00
All other engineering technicians	20	(2)	(1)

Household appliance stores (SIC 5720)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	380	0.71	(1)
Scientists	70	.07	(1)
Computer specialists	70	.07	27.25
Managers of scientists and engineers	10	.01	22.81
Engineers	60	.06	(1)
Mechanical	40	.04	37.67
Other, n.e.c	20	.02	(1)
Technicians	240	.25	(1)
Computer programmer	150	.16	19.94
Drafter	10	.01	43.79
All other engineering technicians	80	.08	(1)

Radio, television, & computer stores (SIC 5730)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	5,480	3.59	(1)
Scientists	960	.39	(1)
Computer specialists	960	.39	19.04
Managers of scientists and engineers	360	.14	13.16
Engineers	920	.36	(1)
Electrical/electronic	380	.15	40.41
Sales	510	.20	20.28
Other, n.e.c	30	.01	(1)
Technicians	3,240	1.30	(1)
Computer programmer	2,020	.82	14.90
Electrical/electronic technicians	950	.38	18.94
Mechanical engineering technician	30	.01	73.67
All other engineering technicians	240	.09	(1)

Eating and drinking places (SIC 5800)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	590	(2)	(1)
Scientists	100	(2)	(1)
Life scientists, unspecified	(2)	(2)	(1)
Computer specialists	100	(2)	71.47
Managers of scientists and engineers	40	(2)	77.81
Engineers	60	(2)	(1)
Mechanical	20	(2)	73.28
Other, n.e.c	40	(2)	(1)
Technicians	390	(2)	(1)
Computer programmer	200	(2)	74.36
Drafter	110	(2)	88.93
Mechanical engineering technician	50	(2)	85.26
All other engineering technicians	20	(2)	(1)
Physical and life science technicians	10	(2)	107.62

See footnotes at end of table.

B-3. Scientists, engineers, and technicians in each trade and regulated industry as a percent of total employment in the industry and the relative error: 1988--Continued

Drug stores and proprietary stores (SIC 5910)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	1,100	0.24	(1)
Scientists	200	.03	(1)
Life scientists, unspecified	10	(2)	80.93
Computer specialists	190	.03	23.39
Managers of scientists and engineers	370	.06	25.95
Engineers	130	.01	(1)
Mechanical	10	(2)	44.15
Other, n.e.c	120	.01	(1)
Technicians	400	.05	(1)
Computer programmer	340	.05	25.26
Drafter	40	(2)	29.38
All other engineering technicians	20	(2)	(1)

Liquor stores (SIC 5920)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	10	(2)	(1)
Technicians	10	(2)	(1)
Computer programmer	10	(2)	50.96
All other engineering technicians	(2)	(2)	(1)
Physical and life science technicians	(2)	(2)	72.88

Used merchandise stores (SIC 5930)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	20	0.03	(1)
Technicians	20	.02	(1)
Computer programmer	10	.01	63.95
All other engineering technicians	10	.01	(1)

Miscellaneous shopping goods stores (SIC 5940)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	1,500	0.26	(1)
Scientists	410	.04	(1)
Computer specialists	410	.04	16.15
Managers of scientists and engineers	150	.01	27.54
Engineers	350	.03	(1)
Electrical/electronic	(2)	(2)	55.85
Sales	320	.03	48.34
Other, n.e.c	30	(2)	(1)
Technicians	590	.06	(1)
Computer programmer	510	.06	11.51
Drafter	50	(2)	55.78
Electrical/electronic technicians	30	(2)	74.35

See footnotes at end of table.

B-3. Scientists, engineers, and technicians in each trade and regulated industry as a percent of total employment in the industry and the relative error: 1988--Continued

Nonstore retailers (SIC 5960)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	2,690	1.72	(1)
Scientists	1,060	.36	(1)
Life scientists, unspecified	10	(2)	50.91
Computer specialists	1,050	.36	19.19
Managers of scientists and engineers	260	.09	16.44
Engineers	270	.08	(1)
Electrical/electronic	160	.05	31.40
Mechanical	20	(2)	23.23
Sales	30	.01	41.86
Other, n.e.c	60	.02	(1)
Technicians	1,100	.36	(1)
Computer programmer	910	.31	9.77
Drafter	10	(2)	32.57
Electrical/electronic technicians	130	.04	43.37
All other engineering technicians	40	.01	(1)
Physical and life science technicians	10	(2)	56.45

See footnotes at end of table.

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	130	0.16	(1)
Scientists	50	.04	(1)
Computer specialists	50	.04	34.07
Managers of scientists and engineers	(2)	(2)	33.46
Engineers	20	.01	(1)
Sales	20	.01	41.97
Other, n.e.c	(2)	(2)	(1)
Technicians	60	.03	(1)
Computer programmer	40	.03	14.39
Drafter	10	(2)	29.58
All other engineering technicians	10	(2)	(1)

Retail stores, nec (SIC 5990)

Field	Total	Percent of industry employment	Relative error
Scientists and engineers, total	500	0.19	(1)
Scientists	(2)	(2)	(1)
Managers of scientists and engineers	20	(2)	34.46
Engineers	120	.02	(1)
Electrical/electronic	30	(2)	63.70
Sales	80	.02	39.44
Other, n.e.c	10	(2)	(1)
Technicians	360	.07	(1)
Computer programmer	140	.03	16.20
Drafter	30	(2)	98.77
Electrical/electronic technicians	120	.03	60.53
All other engineering technicians	70	.01	(1)

(1) Relative error was not computed
(2) Value is less than .05 or was not computed
NOTE: Because of rounding, components may not add to totals.
SOURCES: Bureau of Labor Statistics and the National Science Foundation, SRS.

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